Like arteries and veins that keep the body alive with a constant flow of blood, close to 26,000km of cables, more than 3,240km of gas pipelines and a 3,000-strong team of people work around the clock to keep Singapore's lights on and air cool. Arti Mulchand speaks to the unsung heroes.

Getting power to the people

IN 2004, when Mr Peter Leong oversaw the engineering division at Premas International, which provides property management services, Singapore was hit by one

of its worst blackouts in history. Piped gas supply from Indonesia to Singapore's power stations was disrupted by a technical fault and most turbines were unable to switch to the backup source of fuel. It caused a two-hour outage affecting more than 300,000 homes.

In one home in Jurong, a man had a heart attack and needed to get to a hospital. The lifts did not work. At the time, Premas managed the Jurong Town Council, to which Mr Leong provided engineering support.

"I had to send our contractor up to carry him down. I saw how the residents were affected. Failure can be very serious and I know how important continuity is. I remember that even now," recalled the 57-year-old, who joined Singapore Power (SP) PowerGrid as general manager about five years ago.

That image remains with him, and has served as a constant reminder in his current role as managing director of SP PowerGrid he has to ensure "the lights are always on" for the company's 1.4 million customers.

"Singapore is like a copper mine. There is 26,000km of copper underground because everything needs power. Just like blood needs to flow to every part of the body, electricity needs to flow to every corner of Singapore. And like the human heart, we cannot afford to fail, so we do everything we can and put every effort into ensuring nothing goes wrong."

The three main areas Singapore Power covers are: planning and strategy, that is, planning ahead for energy needs; network develmission and distribution network: tem distress." Mr Leong said. work equipment.

sure the health of the system. We ther online or off – to ensure that The company has been looking line."

ENSURING SMOOTH OPERATIONS



Smart Energy, Sustainable Future

PUWERING LIVES

Building a more resilient grid

THE power grid of the future could include a large number of distributed renewable generation sources such as solar photovoltaics, energy storage facilities and energy

management systems. It is also expected to be flexible and scalable, such that fluctuations in energy demand or supply will not affect the grid's stability

and reliability. A team from the National University of Singapore, headed by Associate Professor Dipti Srinivasan, is working with SP PowerGrid to look into

"dynamic optimisation and energy management for smart grids" It hopes to develop a set

of computational tools that will, among other things, automatically diagnose faults so outages can be handled quickly.

"The team works 24/7 to en- are continuously measured – whe- the world, said Mr Leong.

MARKET AUTHORITY

> responses. Exercises are conducted for grid. everything from network manage-

goes wrong, everyone knows store for the nation - Changi Airwhat to do. has achieved one of the most relia- ment of the southern waterfront

ble grids in the world – the aver- and new container ports at Tuas – age amount of outage time has his eyes lighted up. gone from 27.44 minutes per person a year two decades ago, to morrow," he said with a smile. less than half a minute now.

riod and now.

some 26,000km of cables to more National Productivity Board to bethan 10,000 transmission and dis- come Spring Singapore. tribution substations that convert electricity into the necessary volt- safety on his mind, operating the ages for various uses.

"As power demand grows, it be- and accessories that connected to comes more efficient to push the electricity network, then reguthrough power with higher-volt- lated by PUB, the national water age cables. It is not unlike Singa- agency. pore's highways. Where two lanes He did product testing and also used to do the job, we now have participated in investigations into the Marina Coastal Expressway, electrical deaths. which is 10 lanes wide. As energy When he moved on to Premas, intensity grows, we need a bigger he oversaw the maintenance and highway," said Mr Leong.

The North-South and chillers, lifts and switchboards in East-West Electricity Cable Tun- commercial buildings and techno nel Project is part of that expan- parks, and several town councils. sion. Its two 60m-deep tunnels But it is at Singapore Power opment, that is, building the trans- respond immediately to any sys- will span 35km way below the that he has found a "better sense MRT and even the sewerage sys- of purpose", he said. and network management, that is, Temperatures of transformers tem and, when completed in 2018, "I love being able to look at operating and maintaining net- are taken, insulating oil is will reinforce Singapore's power how to do things differently, and I checked, and other parameters grid as one of the most reliable in can never say that my job is done.

the power paramedics can be sent into how new technologies and enin for swift and often pre-emptive ergy sources, such as solar photovoltaic power, could impact the

PHOTO: LIM YAOHUI FOR THE STRAITS TIMES

Mr Peter Leong, 57, managing director of SP PowerGrid, says that energy demand

in Singapore has increased dramatically between the pre-war period and now.

As Mr Leong listed some of the ment to billing, so that if anything major infrastructural projects in port's Terminal 5, Project Jewel at In the last 20 years, Singapore Changi Airport, the redevelop-

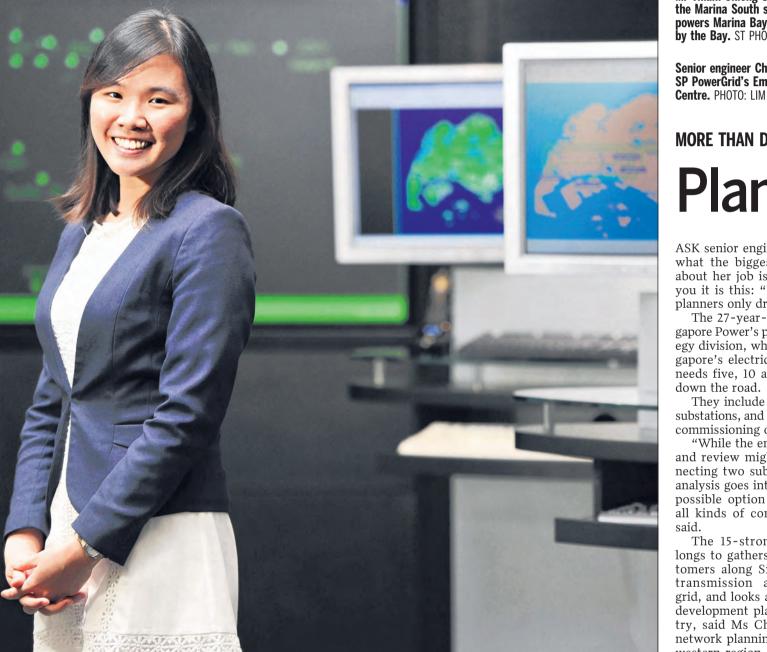
"We have to plan now for to-Mr Leong, who studied electri-But just like Singapore has cal engineering at RMIT Universievolved, so must the power super- ty in Australia and did his mashighways. Mr Leong says that en- ter's at the National University of ergy demand has increased dra- Singapore, began his career at the matically between the pre-war pe- then-Singapore Institute of Standards and Industrial Research, Power is pumped through which eventually merged with the

> There, he spent 18 years with nation's test lab for equipment

operation of equipment such as

This is a journey without a finish





All fired up about keeping businesses cool

SINGAPORE District Cooling's the opportunity to pursue a one-(SDC) senior engineering officer year specialist diploma in workfor safety Ariff Shah Mohd proud- place safety and health at Singaly declares that in his seven years pore Polytechnic in 2009, after with the plant, there has not been which he was promoted to engia single serious accident.

sq m, supplies the chilled water ior engineering officer for safety. that keeps many buildings in the Marina Bay financial district cool. plant's safety matters, including Among his responsibilities: to en- safety precautions that are in sure compliance with safety mea- place, risk assessment, safety comsures and equipment, and make pliance and training. He is also sure that all the permits for ma- the secretary of the plant's chinery are in order.

"I have to cultivate a culture of meets once a month. safety among the staff as well as This father of two is so passionour contractors, and ensure that ate about safety that, this week, the plant has reliability and effi- his team held its first SDC Safety ciency and operates safely. It can Day. Some 70 spouses and chilbe tricky, and you have to be dren of SDC's staff had a alert," said the 39-year-old, who first-hand look at how the plant holds a position more often held works and a lesson on why safety 1991, was also keenly interested in struction phase, I realised they working, ensures that the plants neering.

fore ending up in IT support. installations.

began operations in 2006. SDC is Technical Institute. a joint venture between Singapore Mr Wong, who received his di- Fascinated, he applied for a po- Mr Wong, who also has special- 13-year-old DHCS plant in planned for next year. Power and Dalkia.

neering officer for safety and The plant, which spans 19,000 projects. This year, he became sen-

> Today, he oversees all of the 10-man safety committee, which

an annual affair.

ploma in electrical engineering sition as senior control engineer ist diplomas in energy efficiency Changi – Keppel's oldest DHCS Keppel, which is looking into



Neither Keppel DHCS operations manager Wong Toon Soon (above) nor Singapore District Cooling senior engineering officer for safety Ariff Shah Mohd (right) started their careers in the district cooling field, but both men now power vital aspects of their plants which provide cooling services in various parts of Singapore. ST PHOTOS: CAROLINE CHIA, NEO XIAOBIN

buzzword in the late 1990s.

cal Education graduate who stud- Soon, the operations manager of brand-new sector of district cool- more. This was my opportunity." gains. ied mechanical and electrical draft- Keppel District Heating and Cool- ing when his company became in- Just three years later, he was He was involved in setting up a ing and design, toyed with the ing Systems (DHCS), started out volved in the construction of the promoted to operations manager DHCS plant in the Sino-Singaidea of becoming a policeman be- in construction, doing electrical Keppel DHCS plant in Changi of all three of Keppel's DHCS pore Tianjin Eco-City in 2010, Business Park, Singapore's first facilities. Keppel is the only other where he oversaw everything Eventually, he learnt the ropes Mr Wong, who is now 51 and al- district cooling system, in 1998. provider of district cooling ser- from its construction all the way as an operations technician at a so a father of two, became an elec- When completed, it would pro- vices here, and services 18 custom- to the time the chilled water startpetrochemical plant on Jurong trical foreman after completing a vide cooling services to business- ers in Changi Business Park and ed pumping. It has been up and Island. That led him to a similar full-time Industrial Technician es in the area, including commer- 18 at Biopolis. It also provides dis- running since August. position at the SDC plant, which Certificate course at Singapore cial, banking, biomedical and wa- trict cooling at Woodlands Wafer At the moment, Mr Wong is fer fabrication customers. Fab Park.

After four years, he was given from Singapore Polytechnic in in 2003. He said: "During the con- management and security net- facility - with new and more new sites for DHCS facilities,

by someone who is trained in engi- matters. Safety Day will now be energy efficiency, which was a were using the latest energy-effi- run smoothly, and works closely cient technologies and I was excit- with Keppel's customers to help Mr Ariff, an Institute of Techni- Similarly, Mr Wong Toon He was introduced to the ed at the prospect of learning them maximise their efficiency

planning to refresh the efficient chiller equipment

THE STRAITS TIMES

Mr Thiam Chiong Seng helped build the Marina South substation, which powers Marina Bay Sands and Gardens by the Bay. ST PHOTO: NEO XIAOBIN

Senior engineer Chu Xiao En (left) at SP PowerGrid's Emergency Operations Centre. PHOTO: LIM YAOHUI FOR THE STRAITS TIMES

MORE THAN DRAWING LINES

POWER TRIP Lighting up Marina Bay

WHEN Mr Thiam Chiong Seng which we turn the equipment on drives along the East Coast Park- and you suddenly see 'fireworks'. back-up, keeping the lights on. formation can be harder than one Mr Thiam got involved in the can imagine. way and past the Marina Bay area, We have our biggest fireworks dis- Marina South project in 2000, it is rarely without a smile on his play on National Day and we'd when his team helped outline the speak English, but try finding the

The 47-year-old engineer is Thiam said with a laugh. the director of network development at Singapore Power (SP), substation unique is that it is Sin- Services Tunnel, which was being Chinese is not our native language where he has worked for 16 years gapore's first substation that can built by the Urban Redevelopment for technical terms," he exdoing high-voltage equipment in- receive bulk energy transmissions Authority at the time. stallations, including at the Mari- at 230 kilovolts (kV) from the pow- Those tunnels, which sit be- the types of insulation materials na South substation.

That means keeping the lights on in iconic buildings that include voltage at which some consumers electricity to chilled water and been eye-opening, not least be-Marina Bay Sands, the Marina Bay can use it. Financial Centre and Gardens by the Bay

we are literally powering it. You but new equipment allows it to by- able to support them in the develcan see and feel the impact," he pass that intermediate stage. That opment," said Mr Thiam, who derstand that electrical cabling is said. "That's why it's very excit- means saving on space and equip- oversees a department of 18, in- for the good of the country. Here? ing being in the energy business. ment cost. You're not dealing with tiny electronics. What we build is so huge station is 300 megavolt amperes cal and electronic engineering at can work only a limited number of so you feel a real sense of satisfac- (MVA) - meaning it can power up Nanyang Technological Universi- hours at night because residents tion when you see a job complet-

SP's network development engineers develop and build the in- ture-proofed it so it can deal with ing maintenance work on 230kV station project, for instance, one frastructure that ensures continu- the area's expansion," he ex- transformers. He was so im- 900m stretch of road between Anous and reliable power supply to plained, adding that the substa- pressed with Singapore Power son Road and Cecil Street took alhouseholds, as well as industrial tion is capable of servicing the that he ended up applying for a most two years to complete beand commercial buildings. This in- area's needs for at least the next job. He has not looked back since. cause work could be done only becludes forging the fit between net- decade. work demand and supply, con- The substation also has three is that other countries look to Sin- er work had to be finished by ducting simulations and doing sets of 230kV cables to create a sit- gapore for the types and technical 10pm.

fore it is used. "We don't want a situation in the other two function as cesses. But communicating this in- finish it up in just months."

What makes the Marina South South-east Asia's first Common pylene laminated paper (PPLP). er generation companies and then tween 2.5m and 20m under- used in cables. convert it to 22kV, which is the ground, deliver everything from

verted to 66kV before being recon- CBD (Central Business District) for disruptive electrical and road "With Marina Bay, I know that verted to 22kV or lower voltages, had to be expanded, and we were works.

> The current capacity of the sub-Mo Kio Town. "But we have also fu- moving to an SP subcontractor do-

tests and checks on equipment be- uation of "double redundancy", specifications of equipment used "In other countries, they

Planning for the next generation

ASK senior engineer Chu Xiao En such as Choa Chu Kang, Jurong, two," said the Singapore Power had been laid under Upper Bukit fore the segment was isolated, what the biggest misconception Woodlands and Ayer Rajah. about her job is and she will tell Part of the job includes carry- trical engineering at Imperial Col- construction of Downtown Line 2, proceed to dig up the road, find you it is this: "People think that ing out simulation studies, plan- lege and her master's at Stanford which is due to be completed in the fault and fix it. planners only draw lines."

egy division, which plans for Sin- lowest cost. gapore's electrical infrastructural needs five, 10 and even 20 years

ssioning of old ones.

and review might be a line con- the national energy demand," she ing with a live network. You need Management made her an unlikely means gratification is much necting two substations, a lot of explained, adding that based on to have a step-by-step contingen- sympathiser when a fire broke out delayed, since most of the analysis goes into exploring every the latest estimates, energy de- cy plan for anything that might go at SingTel's Bukit Panjang facility projects she has had a hand in possible option and anticipating mand in Singapore could grow be- wrong," she explained. all kinds of contingencies," she tween 2.2 per cent and 3.7 per The four years that Ms Chu has services across the island, includ- ality, it makes the job no less ful-

The 15-strong team she be- and 2023. longs to gathers input from cus- It is that kind of work that ap- company's Melbourne-based sub- lowing a fault that tripped a cir- first-hand in nation-building. tomers along Singapore Power's peals to the self-confessed ap- sidiary Jemena, and eight months cuit in Woodlands in 2009, had to And I appreciate that the good pertransmission and distribution plied mathematics and physics in Network Management, a depart- walk along roads that had cables formance of our network today is grid, and looks at the growth and fan.

The 27-year-old works in Sin- sites, and figuring out how to get Power in 2009. gapore Power's planning and strat- the best possible network at the

mits an updated 10-year plan to of electrical infrastructure that side other utility providers. I am the network. When these things the Energy Market Authority was created in the 1980s, but now a lot more tolerant of road happen, you are really trying your They include the need for new (EMA), which takes into account there are limitations on what can works," said Ms Chu, whose hus- best to get things back up. I undersubstations, and the renewal or de- developments and changes. be done. "The EMA works top down and "Most of the renewals are done in the power sector.

"While the end result of a plan we work bottom up to forecast in mature estates, so you're work- The time spent in Network cent each year between this year been at Singapore Power have in- ing her pay TV services at home. filling.

scholar who did her degree in elec- Timah Road to make way for the and only then could contractors ning cable routes and substation University. She joined Singapore 2016.

es. For instance, her department line. There is a lot of preparatory dent, I felt appreciative of what Each year, her department sub- is looking into the renewal of a lot work that has to be done along- they were trying to do to restore

cluded a three-month stint at the She was part of a team that, fol-

ALL the action at what is arguably properties of the water to, for inthe world's largest district cooling plant by capacity is well hidden the air passing through the from public view. The plant is lo- air-conditioning system. cated five floors – about 25m – un- There are three interconnected derground.

plant's existence is a cleverly con- other two plants are at One Rafcealed cooling tower, which pops fles Quay and One Marina Bouleup above the ground facing Mari- vard – and there are plans to grow

na Bay Sands' hotel building. low exhaust heat to escape the be serviced. tower shimmers in the sunlight, and a strategically placed water lies in being able to maintain the feature masks the sound of the wa- temperature of continuous water ter that flows from it. produces 600 tonnes of chilled that standard is met 99.9999 per

water per hour, is like a scene out cent of the time. of Alice in Wonderland – there is underground.

utilities continuously pumped networks can be used to supply through a network of common ser- heating, as is the case with Kepvices tunnels to 14 customers in pel's District Heating and Cooling the area, including Marina Bay Systems plant at the Sino-Singa-Sands, the Marina Bay Financial pore Tianjin Eco-City in China. Centre and One Raffles Quay. Keppel also has three district coolficient and cost-effective method Changi Business Park, Biopolis to provide buildings in the area and Woodlands. with an optimal indoor climate. In While it is more common in the the case of Singapore District United States and the Middle Cooling, chilled water is produced East, district cooling is catching by production plants and distribut - on in Asia, said Singapore District ed by water pipes contained with- Cooling managing director Jimmy in the common services tunnels. Khoo, adding that the Marina Specially designed units within South substation is a "true suceach building draw on the cooling cess story for Singapore".

ter of 2015.

most recently secured the con- Mr Wong is most encouraged much to benefit from this, both in smaller carbon footprint. building owners and tenants have term, it also means having a concluded.

tract to provide district cooling to by the growing footprint of dis- terms of lower investment costs "It is better for business, and Mediapolis from the second quar- trict cooling, especially since and energy savings. In the longer better for the planet as well," he

development plans for the coun- "I have always been a rational power supply to customers does fault detectors and special head- my mentors and the planners that try, said Ms Chu, who oversees and logical person so that's what not get disrupted. network planning for Singapore's attracted me to engineering. I like She worked on, for instance, segment. western region. She covers areas that one plus one will always be the diversion of power cables that CHILLING UNDERGROUND 38E2

telecommunication cables.

cluding six engineers.

"In China, it would be rude to

like to keep it that way," Mr technical requirements for trans- Chinese word for cross-linked mitting power through polyethylene (XLPE) or polyproclaimed with a laugh, referring to

His overseas exposure has also cause of the much higher toler-Usually, power has to be con- "The Government realised the ance level other countries have

"In China and India, they un-We have to work at night or traf-Mr Thiam, who studied electri- fic would be obstructed, and we an area up to twice the size of Ang ty, started out in an industrial complain about the noise," he air-conditioning company before said, shaking his head.

During the Marina South sub-What he is especially proud of tween 8pm and 4am and the noisi-

so even if one set is knocked out, and even quality control pro- would just block off the road and

She said: "While the public "I never realised how much was asking why there were no The job has multiple challeng- went into the planning of an MRT back-ups during the SingTel inciband is also an electrical engineer stand how challenging that can

> And while being a planner also in October, disrupting a range of planning have yet to become a re-

"We get to be involved ment tasked with ensuring that under them, armed with cable the result of the work of some of phones to identity the problem have come before me.

"Now, we're planning for the It was about a day and a half be- next generation."



plants in Marina Bay spanning a The only evidence of the total of about 19,000 sq m - the this to five plants, so more than A curtain of metal plates that al- eight million sq m can ultimately

The success of a cooling plant flow at under 6 deg C. Even access to the plant, which At Singapore District Cooling,

Using a district cooling facility no signage, only a small door locat- - as opposed to having to build ed at the end of the Double Helix and install their own plant rooms

Bridge. Stairs and a lift transport and cooling towers – helps make the plant's 52 employees deeper businesses in the area about 30 per cent more energy-efficient. Chilled water is one of several In temperate countries, similar

District cooling is an energy-ef- ing plants. They are located in